QUALITATIVE ANSWERING SURVEYS AND SOFT COMPUTING*

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ABSTRACT:

In this work, we reflect on some questions about the measurement problem in economics and, especially, their relationship with the scientific method. Statistical sources frequently used by economists contain qualitative information obtained from verbal expressions of individuals by means of surveys, and we discuss the reasons why it would be more adequately analyzed with soft methods than with traditional ones. Some comments on the most commonly applied techniques in the analysis of these types of data with verbal answers are followed by our proposal to compute with words. In our view, an alternative use of the well known Income Evaluation Question seems especially suggestive for a computing with words approach, since it would facilitate an empirical estimation of the corresponding linguistic variable adjectives. A new treatment of the information contained in such surveys would avoid some questions incorporated in the so called Leyden approach that do not fit to the actual world.

KEY WORDS: Computing with words, Leyden approach, qualitative answering surveys

1. INTRODUCTION

The expression *computing with words* was introduced by L. Zadeh (1996), to appoint the automated reasoning by means of linguistic expressions, in a similar way to which the reasoning in human beings is carried out. This type of approach can be fundamental to undertake certain type of economic investigations applied to the actual world. In fact, fuzzy logic concepts are being already implemented in

certain fields of this discipline[1]. We will talk later about some applied fields of Economics in which the *computing with words* approach seems especially advisable.

In our opinion, at less in some fields, Economics should not assume epistemological principles and methods identical to the natural sciences. As a *soft science*, at least in those fields more related to the social and psychological behavior of the human beings, it should be seen with interest the use of *soft methods* for those questions that demand it. Taking the alternative significance in the Oxford American Dictionary for the verb used in the subtitle of a well known L. Zadeh's paper (1999: "From **manipulation** of measurement to manipulation of perceptions"), it will be always more honest, and will turn out to be more certain, although at the cost of seeming less exact, to abandon the temptation of **manipulating** ("*alter or adjust it to suit one's purposes"*) the measurement scale of

[1] There has been a wide application of different fuzzy techniques for different areas of research within economics. In the area of human well-being the applications are predominantly on poverty measurement. Baliamoune (2003) applies for the first time fuzzy-set theory to macroeconomic and social indicators of human well-being. Other studies that used fuzzy logic to measure poverty with microeconomic data can be seen in Cheli and Lemmi (1995), Cheli (1995), Chiappero (1996 and 2000), Lelli (2001) and Qizilbash (2002). Some attempts to apply fuzzy set theory to macroeconomic data can be seen in Von Furstenberg and Daniels (1991) and Baliamoune (2000), who use this theory to assess the degree of country compliance with the G-7 economic summit commitments, in Stroomer and Giles (2003) where income convergence is studied through fuzzy clustering, or Diaz et al (2000) where a neuro-fuzzy inference system is applied to the study of wage employment in Spain. Other works are focused on fuzzy utility and equilibria, like P. De Wilde (2003) and Yager (2000). A field of growing interest for applications is environmental and sustainability studies such as the one carried out by Botteldooren and Berkein (2003) in which the fuzzy noise annoyance model was tested on two surveys in Tirol, Austria and in Flanders, Belgium, or the ones carried out by Munda (1995), Janssen and Munda (1999), Van Coten et al (2001), Tran et al (2002), applying fuzzy decision analysis. In Teodorescu et al (1994), Morillas et al. (1997), Matsatsinis et al (2003) and Garcia-Lapresta and Llamazares (2003) other applications and/or proposals of fuzzy decision analysis algorithms can be seen. Gil Aluja (2004) provides an overview of economic and financial problems involving fuzzy decision making. In actuarial and financial time series analysis works like Kodogiannis and Lolis (2002), Marcek (2004), Watanabe et al (2004), Sanchez and Terceño (2003) can be found. A good review of applications of fuzzy logic to actuarial science has been carried out by Shapiro (2005). Some other aspects of modelling both with the use of fuzzy inference systems, sometimes in combination with neural networks and/or genetic algorithms, and fuzzy regression analysis can be read in Fedrizzi et al (1993), Kooths (1999), Profillidis et al (1999), Landajo (2000), Lin and Yao (2002), Diaz and Morillas (2004).

certain economic phenomena since by utilizing methods that are non adequate to interpret it correctly one distorts reality.

Certainly, mainstream economics has been mainly reluctant to consider as belonging to this science anything that cannot be strictly quantified. It is known that some of the more influential classical economists did not have very good opinion of certain not strictly quantitative positions of other authors. Irving Fisher (1961) said about *utility*, a basic concept in the structure of the economic thought, that "Utility is the heritage of Bentham and his theory of pleasures and pains. For us his *word* (utility) is the more acceptable, the less it is entangled with his theory". Another classical economist, Lionel Robbins (1932), in the chapter titled "The nature of economic generalizations", expressed his serious doubts about the possibility of measuring the utility on a cardinal scale. In spite of recognizing that there are certain aspects of behavior that economists cannot explain without invoking subjective or psychological processes, he even said that appraisal is a subjective process that cannot be observed, remaining, therefore, outside the realm of scientific explanation. Its measurement, therefore, would be a theme that remains reserved for psychologists and maybe physiologists. All we need to suppose as economists is the evident fact that different possibilities offer diverse incentives and that those incentives can be ranked. The 2002 Economics Nobel prize, offered to psychologist Daniel Kahneman, "for having integrated insights from psychological research into economic science, especially concerning human judgment and decision-making under uncertainty", may not make Robbins reconsider these ideas, but, at least, it should give pause to the many economists anchored in the most intransigent orthodoxy.

Utility and its measurement are relevant to many economic fields, especially those of: consumer behavior, poverty and welfare studies, well-being and

quality of life, subjects “which are considered immeasurable and esoteric by most of the economic profession” (Van Praag and Frijters, 1999). It is in these kinds of problems, in which the information is usually qualitative and obtained from verbal expressions of individuals by means of surveys, where the computing with words methods can have a more promising future in the applied economic field.

First, we will briefly reflect on some questions about the measurement problem in economics and, especially, their relationship with the scientific method[2]. Secondly, we will give an example to show that statistical sources frequently used by economists contain information more adequately analyzed with soft methods than with traditional ones. Finally, we will comment some of the most commonly applied techniques in the analysis of these types of data with verbal answers and we will consider the way one can compute with words. This discussion is pursued to serve as a background for a particular analysis of a survey which we well present later.

2. THE MEASURING PROBLEM IN ECONOMICS

The justification of the scientific method has a pragmatic component: we do not know other rules that better fit the purpose of Science. Its norms are based on the science and logic laws. According to its principles, we can replace the manipulation of things and events by the use of symbols, allowing us to operate with facts representations and their relations, rather the things and their relationships. But we can never do with numbers, passive subjects of the arithmetic manipulation, what would not be logical to carry out with the objects that they represent. It is a matter of a basic question in relation to the measurement problem

[2] It is not our objective to undertake in depth on these themes. We only comment some questions that we think are of interest in relation to computing with words.

in any science. Evidently, this should have an immediate consequence on the type of method that should be used in each particular situation.

In this sense, the methodology in social sciences enables us to establish the relationship between theory and the domain of reality to which it refers. It allows us to transform the observed reality in theory and to contrast it. Methodology, above all, organizes and structures the way we think.

Without doubt, Karl R. Popper's ideas on the scientific method had a great influence in economics, in spite of his confessed doubts as to whether the methods of investigation in natural sciences were relevant to social sciences. Nonetheless he was clear that we always learn by means of criticism. Furthermore, he affirmed that the difference among methods can be as large as wanted. Leaving aside his discussions with Kuhn and the Lakatos contribution about this subject, we want to recall here the pragmatic position of the theoretical anarchism representative, Feyerabend (1984). He stood for the non-existence of a unique official methodology that produces results. His attack falls, above all, on the progressive influence on its own method that a particular science exercises. He challenged the pretension of the scientific establishment that only they know the correct method to discover truth. Feyerabend also made economists see that it was not possible to claim for economics the same scientific method than for natural sciences[3].

Epistemological problems, as well as elaboration and knowledge evaluation criteria are seen as essential by Georgescu-Roegen (1969). He points out that

[3] Morgenstern (1963; p. 17) said, nevertheless, that the relationship among theory, measure, and data should be as tight in economics as it is in physics. This is without any doubt an unrealistic pretension, but that spoke clearly of the positivist will of some economists in the fifties of the past century. Just the opposite is the opinion declared by Neuberg (1989; p. XII) after deeply analyzing a social experiment, who said that economics, in spite of its math, is much less able to explain society than physics is able to explain nature.

methodological problems should be called epistemological problems. For this author, "the progress of science can not be done without a continuous criticism of epistemological problems". (op. cit, p.16). In the foreword of this book, Samuelson demands the attention of some of the paradoxical views in his essay: "… we must accept that in certain instances at least, 'B is both A and non-A' is the case".

A logical positivist would deny the possibility of working with these types of "dialectic concepts", in the sense of Georgescu-Roegen[4] (1969; p.24), that is, the ones that may violate the Principle of Contradiction, clinging to numbers and "arithmomorphic concepts", and denying the validity of propositions formulated without precision[5].

Nevertheless the author points out that he idea that "knowledge only exits if it is expressed by arithmomorphic concepts"… reminds that of the old Catholic Church: the divine thought cannot be expressed but in Latin (op. cit; p.28). The truth is that our thinking is expressed on dialectic terms, without an absolutely clear meaning and is this kind of language the one with which men really in favour of precision in science, as Bertrand Russell, have built their arguments.

We can say that if science is measurement (Galileo), exaggerating the value of that measurement we are in risk of losing completely the contact with the real object (Plank)[6]. In this sense, the epistemological problem in the scientific

[4] He says a penumbra separates a dialectical concept from its opposite. This idea can be considered very close to fuzziness.

[5] In spite of the fact that Kant proposed explicitly an intermediate way in his logical system and Hegel would incorporate the "becoming" or to be between "be" and "not be". In spite of the fact that later Bruno de Finetti, Lukasiewick and Mazurkiewick would consider a polyvalent logic in a continuous scale of modalities. And in spite also of the fact that precision and certainty have often opposite ways.

[6] These quotations are taken from Georgescu-Roegen (1969). In other book, key for the ecological economics, translated into Spanish in 1996, this author writes: "We have to say again that the "arithmomorphic" models are indispensable in economics, no less than in other scientific fields. That does not mean that they can also do all what can be made in economics because, as Schrodinger said

method is crucial. For example, we the economists should learn that sometimes the less precise model can be the most reasonable one to use (Friedman, 1953) and that we have to know in each moment what we can do with numbers and when we cannot do without them (Georgescu-Roegen, 1969).

It is evident then that the epistemological problem is fundamental and has a lot to do with the scientific methodology and the future development of the theory. We have to point out, that criticism of social science because its method differs from that of the "hard" sciences is a methodological criticism both from a radical point of view: the impossibility of measurement of their objects and from a more pragmatic one, based on the fact that there hasn't been enough effort dedicated to improve the measurement systems.

3. SOCIOECONOMIC STATISTICS WITH VERBAL ANSWERS

Knowledge about subjective welfare of individuals is getting more important every day. In the most developed societies this information influences the political action which is guided by the information obtained directly from citizens through opinion surveys. Today is quite usual to find statistics, either official or not, that ask directly to the interviewee about their level of satisfaction with their present life, their work, with the local or national government, the environment, etc.

It has been said that economic questions are important in so far as they deal with options that can affect people's happiness (Oswald, 1997). Therefore,

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in the field of biological life, the difficulty of the object of economics is not in the mathematics that they need but in the fact that the object is too complicated to be totally accessible to mathematics" (p.418). In this same direction says Esteve (1997, p.17) that the problem of the conceptual definition of the quantitative variables in the National Accounting is "fruit of the difficulty in translating the abstract precision of the concepts of economic theory to the imprecision or fuzziness that characterizes the definition of the economic agents, the structure and the behaviour of economic phenomena in the real world".

social and economic politic decisions should have as main objective the welfare of the individuals. The goal of economic analysis and the surveys on which they are often based, should be that of understanding what people really value and what makes them happy (Frey and Stutzer, 2001)

As we have said previously, there is a majority opinion among economists according to which personal judgments and other subjective opinions are a "black box" that should only be opened by psychologists and sociologists, and furthermore cannot be used for economic analytic purposes. Probably, "one reason for the tendency in economics to concentrate only on 'revealed preference' relations is a methodological suspicion regarding introspective concepts. Choice is seen as solid information, whereas introspection is not open to observation" (Sen, 1982; p. 9). Nevertheless, it can be affirmed that "by detaching economics from the psychology of "feelings", economists have found it difficult to have anything relevant to say on a whole range of issues" (Van Praag and Frijters, 1999; p. 415), given that almost all economic fields have to do with people and with their behavior when they have to choose among different alternatives; with the theoretical idea of utility, all in all. In this direction, different procedures have been adopted to experimentally measure utility through verbal quantifiers. These procedures go from the two best-known proposals in the literature, like Cantril's (1965) or the Leyden approach (Van Praag, 1971; Van Praag and Kapteyn, 1994), which suggests a way to obtain a cardinal measure of the utility, to many others given by various economists carried out in very different ways and contexts[7].

All these investigations have shown that the linguistic variables, as they are called by Zadeh, contain useful information to predict and to understand the

[7] See Clark (1996), Easterlin (1995) and Gershuny and Haplin (1995), for example.

behavior of individuals. It is hardly surprising, therefore, that these kinds of questions have been incorporated in the most important official economic statistics.

The main source of economic information supplied by means of verbal quantifiers are the surveys that the official institutes of statistics and other similar agencies (INE, EUROSTAT, are the ones used most in Spain) carry out. The information is collected as verbal answers to diverse questions in which the interviewee is requested to respond according to an ordinal scale, given besides a numerical evaluation. Although ordinal and cardinal processing often yield very similar results in subjective welfare functions being true or not (Frey and Stutzer, 2000; Gamero, 2003), the choice between them have serious repercussions on the suitability of the analysis techniques applied and, even, on the interpretation of the results reached.

Table 1

SATISFACTION IN DIFFERENT FIELDS

VARIABLE	**DESCRIPTION**
PK001	SATISFACTION DEGREE IN RELATION WITH YOUR PRESENT SITUATION, IN THE WORK OR MAIN ACTIVITY ("1" SIGNIFIES "VERY DISSATISFIED" AND "6" "FULLY SATISFIED") DEGREE OF SATISFACTION……...1-6 DON'T KNOW……..-9
PK002	SATISFACTION DEGREE IN RELATION WITH YOUR PRESENT ECONOMIC SITUATION ("1" SIGNIFIES "VERY DISSATISFIED" AND "6" "FULLY SATISFIED") DEGREE OF SATISFACTION……...1-6 DON'T KNOW……..-9
PK003	SATISFACTION DEGREE IN RELATION WITH YOUR PRESENT SITUATION, WITH REGARD TO THE CONDITIONS OF YOUR DWELLING ("1" SIGNIFIES "VERY DISSATISFIED" AND "6" "FULLY SATISFIED") DEGREE OF SATISFACTION……...1-6 DON'T KNOW……..-9
PK004	SATISFACTION DEGREE IN RELATION WITH THE QUANTITY OF TIME

VARIABLE	DESCRIPTION
	THAT YOU CAN DEDICATE AT PRESENT TO LEISURE (“1” SIGNIFIES “VERY DISSATISFIED” AND “6” “FULLY SATISFIED”) DEGREE OF SATISFACTION……...1-6 DON’T KNOW……..-9

Source: Household Panel Survey (European Union)

For example, the Household Panel Survey is, without any doubt, one of the nowadays most analyzed surveys by the economists in the European Union. In this survey numerous questions with verbal answers appear. Some examples are shown in table 1.

In the questions carried out in table 1, it is assumed that individuals are able to describe their utility levels by means of verbal labels, adjectives of a linguistic variable, as measures of the expected utility. It is obvious that behind the scoring indicated by the polled there is actually a subjective judgment emitted in an imprecise way: the perception this individual has on his welfare, keeping in mind his own circumstances and those of the present environment, the past ones and the ones that are expected in the future. The scale of measure, given the way the questions are presented in the survey, cannot be other than the ordinal one. The values assigned (from 1 to 6, in this case) can only express the hierarchical order in the experienced individual satisfaction. Nevertheless, who has not noticed that “most actual studies conducted by economists start with very general ‘ordinal formulations’ but after a while present a structural specification that nine times out of ten turns out to be of the cardinal type”? (Van Praag and Frijters, 1999; p. 415).

The explanatory causal model for these types of variables is usually implemented by the so called ordered probit, because the multinomial *logit* or *probit* models are not adequate given the ordinal nature of the dependent variable

(Zavoina and McKelvey, 1975; Green, 1999). It is assumed normally distributed disturbances, so the dependent variable, in spite of the clear asymmetry of the answers shown usually in the empirical data and the ordinal scale of aforesaid variable, disguised with the numerical appearance of a cardinal discrete variable. Furthermore, it is not clear how coefficients should be interpreted, "point that seems to be uniformly overlooked in received literature" (Green, op. cit. p. 674).

It should also be noted that appraisals carried out by different persons may not be comparable since it can be hardly assured that all individuals interpret verbal answers exactly in the same way. It means that the verbal answers are imprecise and they cannot be delimited exactly for the universe of individuals in the sample: they are *fuzzy*. Then, we have to look for an alternative procedure both for getting the information (survey) and for the methodological approach used to analyze it.

4. METHODOLOGICAL ALTERNATIVES

Maybe the most known proposal to enable the use of a cardinal measure from this kind of verbal answers is the one called the "Leyden approach" (Van Praag, 1991), which evaluates the utility experienced by each individual assigning a numerical value to each of the different verbal answers, using the Income Evaluation Question (IEQ). The goal of that question is to make the individuals assign a cardinal value to the corresponding verbal labels and it is asked, approximately in this way:

"*What after tax total monthly income would you consider for your family as*[8]":

[8] It is possible to generalize this kind of question to any area, leaving instructions to value the answers in a scale ranging from 0-100, for example, if there is no way to measure the variable.

Very bad	about	$
Bad	about	$
Insufficient	about	$
Sufficient	about	$
Good	about	$
Very good	about	$

It is assumed that the a priori distribution is uniform. The discriminate power of the discrete scale (intervals for the labels) is measured with the unconditioned entropy ($\sum p_i \ ln \ p_i$). It will have its maximum when the probabilities of the intervals are equal. Assuming that the valuations are in the middle point of the interval, this implies that rescaling to a continuous scale in the interval [0,1], the general formula to assign a utility level to the i^{th}-label will be *(2i-1)/2k*. It is called the Equal Quantile Assumption (Van Praag, 1971 y 1991). The welfare function, being c_i the mean income of the i^{th}-interval and once adequately rescaled would be:

$$U_n(c_i) = (2i-1) / 2k, \qquad i = 1, 2, \ldots, k$$

From here, there would be the “right” to use hard theoretical suppositions and analysis methods (log-normality, continuity of the function, etc.).

This method has been largely defended and applied by the so-called Leyden school and has a good reception in the economic literature, because of its interest. Nevertheless, some of the questions that they present produce some doubts. For example, the hypothesis of equal intervals does not need to be a universal one. An example free of context does not guarantee its generalization, as they claim. Simply, the “no-context” is its particular context and it should not be

presupposed that in different circumstances the answers would follow the same pattern. In fact, our survey seems to demonstrate this, as we will see later.

It is not either guaranteed that the verbal labels would be interpreted the same way by different respondents. A low income for some people could be enough for some other people under equal objective conditions. A high income has very different meaning for different people. It is not true that the verbal quantifiers have the same meaning for all the people asked, even if they belong to the same society and have the same language. This problem cannot be eluded saying that "this is a question of psycho-linguistics" (Van Praag y Frijters, 1999; p. 419).

All in all, it is perfectly plausible that the adjectives of the linguistic variable "level of income" (intervals) were not equal nor exclusive, but of different size and overlapped.

If, moreover, the numeric valuations assigned are based in a perception of the interviewee, there is another reason for them to be considered as fuzzy sets. The most important question is, nevertheless, and this is the reason why we have chosen this specific approach of data analysis with words, that the way the questionnaires are made can allow us to say something about the membership functions. This way, it would be possible to work with techniques connected to computing with words and all the information given by the survey could be used, since its usefulness would not be reduced to assign a mean to each of the intervals to estimate subsequently the cardinal utility function.

To illustrate our arguments, and as an exercise, we have carried out a survey to 136 students of the second course, to which, among other questions, we asked:

"Suppose that you have finished your studies. Which is the net income you would consider as?":

Very low	approximately	€
Low	"	€
Not low, nor high	"	€
High	"	€
Very high	"	€

The answers to this question give very enlightening results with respect to all our previous comments. As a summary, we present the box-plots for each one of the five labels in the question. To avoid outliers and make analysis more robust we will use the 20% trimmed variable for each of the labels.

In Figure 1 it can be observed that the range of the stipulated incomes do not have the same size nor they are mutually exclusive. Although this contradicts the suppositions of the Leyden approach previously seen[9], both are absolutely logic and agree with what we know about the human behavior.

[9] We are not going to discuss now other hypothesis assumed in this and other approaches on satisfaction and well-being, like normality, which is questioned by the empiric evidence of the data that we are showing.

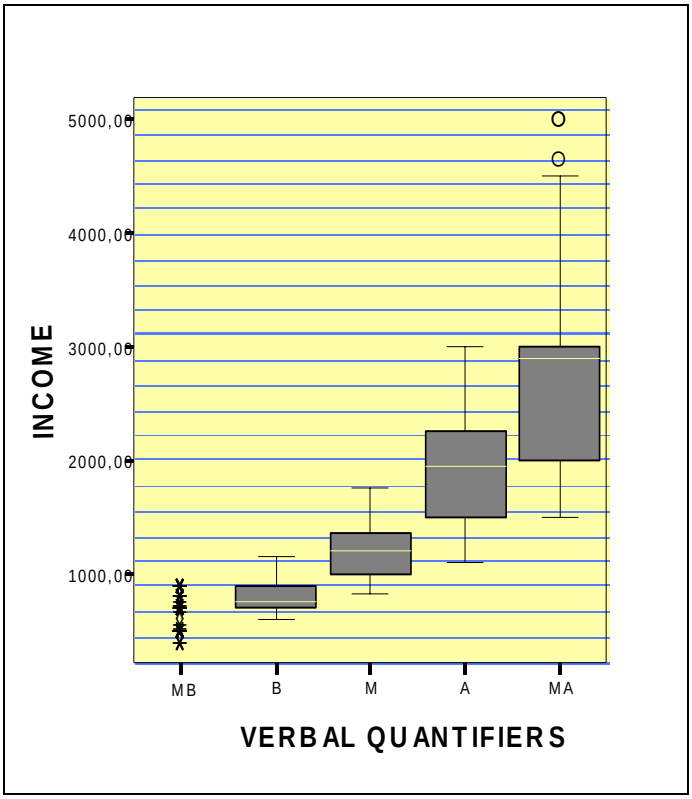

Figure 1: Box plots for verbal quantifiers

On the one hand, in the low level of incomes there is less variability in the individual's perception of well-being than in the high levels of income. The margin of opinion on a minimum salary is shorter than on a salary defined as very high, for example. And this is clearly reflected by an increment in the dispersion in the answer related with the increase in the level of income.

On the other hand, the intervals (labels or verbal quantifiers) are not really exclusive. The individuals perceive in a different way their needs and they do not

understand in the same way a high or very high salary, even if they belong to the same academic course and speak the same language. But it seems that some limits are shared, since from the answers we can deduce the existence of two clear modes: one in the lower interval (very low salary: 600 euros) and another one in the upper one (very high salary: 3000 euros).

The empiric evidence shows that the ordering of the verbal expressions established by the answers of the individuals to the question posed to them does not need to be a strict order and it can instead give rise to a fuzzy ordering. It is also reasonable to think that this will happen in similar circumstances to the one used here, when one works with variables based in subjective perceptions. If one accepts this evidence, the usage of computing with words, would not only be more appropriate, but it would also allow us to be more realistic and it would soften the analytical treatment of data. We know nevertheless that the assumption of those behaviors would create some problems in some aspects of the economic theory. But this is not the moment to think about that.

Our suggestion from this work is that even if we think it is really interesting this way (IEQ) of asking the questions in the surveys, the information could be used in a more appropriate way, making use of all the information and using and analyzing it by means of a more adequate methodology related to soft computing.

With respect to those methods, we want to emphasize that besides the adequate treatment of numerical and linguistic variables in a simultaneous way, they are based in non-parametric methods and then they elude the problems derived of the not very realistic theoretical hypothesis usually presupposed. With the information given in this way, it would be possible to estimate the membership

functions for each of the verbal quantifiers[10], from the evaluation in numeric scale of the meaning of each label given by the people answering the question.

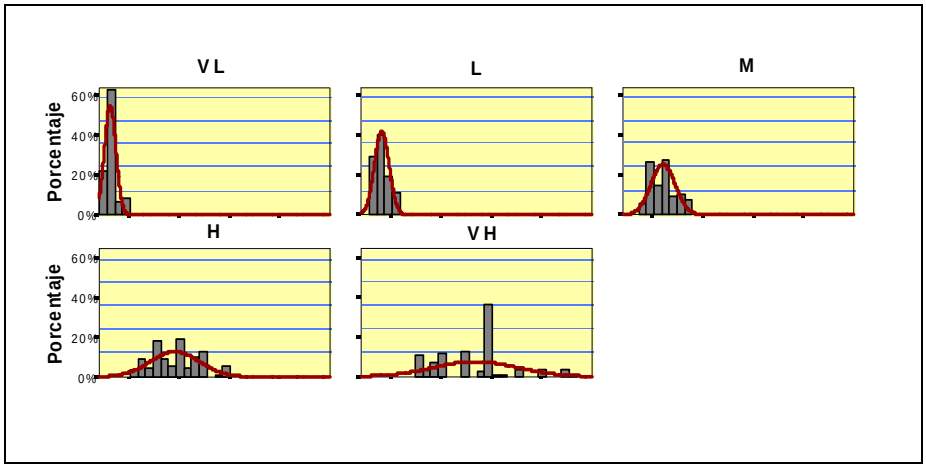

Figure 2: Distributions of Income Verbal Quantifiers

In Figure 2, in which the histograms for each of the verbal quantifiers obtained from the survey are shown, it can be seen that this possibility exists. Besides, these kinds of surveys usually have thousands of data and so, if the responsible administrations changed the questions in the direction of the IEQ, the application of soft computing methods in the research in those areas of economics related to perceptions would be fully feasible. And, without any doubt, they would be more satisfactory and respectful of the limitations of these kinds of data.

5. CONCLUSIONS

[10] Given that in this example the variances of the intervals are not the same, but increase in the same direction that the order of the labels, it would be advisable the use of type 2 fuzzy numbers to take into account the fact that the different labels are not interpreted with the same precision by all the answerers. See, Mendel (2001).

The natural sciences have a great advantage respect to economics: the possibility to carry out and to repeat controlled experiments in a laboratory. In spite of the intents of so called experimental economics, it is evident, in general, that economists do not have that option. Our greater source of evidence, if not the unique one, to contrast and to develop the theory, are the socioeconomic statistics collected by private and public agencies or private surveys carried out for singular investigations.

If the information supplied by those statistics is strictly cardinal, there are econometric and statistical methods that can adequately deal with it. Also, other options connected with the so called "statistics without model" exist. These have the advantage of leaving the data "speak" without being subject to prior theoretical hypothesis (neuronal networks, fuzzy or not, data mining, knowledge discovery, etc.)

But, on the other hand, it is getting more frequent to incorporate questions with verbal answers in large socioeconomic databases, and that should give a chance to a greater utilization of techniques related to the computing with words. Nevertheless, the way the questions with subjective answers are designed in the questionnaires does not permit, currently, an analytic processing based on these types of techniques, unless the intervals for the labels and the membership functions were designed arbitrarily. The Income Evaluation Question, although formulated with other pretensions, seems especially suggestive for a computing with words approach, since it would facilitate an empirical estimation of the corresponding linguistic variable adjectives.

In this sense, we have shown that some questions incorporated in the Leyden approach do not seem to be adapted to the real world. But, simultaneously,

it has been verified that some aspects are closer to fuzzy logic and its methods than the traditional exact approximation, which would support computing with words as the adequate method.

Where, then, is the area of economics in wich these soft techniques could be best applied? All in all, where is situated, therefore, the gap in which the computing with words would be able to be developed in economics? Without any doubt, such possibility is greater in surveys with verbal answers (data with words). This type of information is almost always related to perceptions that individuals have on an extensive group of themes, that go from personal satisfaction and welfare, to the subjective appraisals done by consumers about the goods and services they get from firms and the analysis of financial and business expectations. Sadly, the way in which the official surveys ask the questions that can turn out to be prominent for these investigations is not satisfactory and they only give the option for an ordinal data processing framework. Nevertheless, in spite of this limitation, they are used applying hard techniques that turn out to be inappropriate for that scale of measure.

What can be done on it? In my opinion, it should be necessary to work in two directions:

- Firstly, to promote a more adequate design for questionnaires to make surveys reveal, even if vaguely, the expected cardinal utility (subjective) in the sense of Kahneman and Van Praag.
- Secondly, once its fuzziness has been shown, take advantage of this information to work on the words vagueness and imprecision with more adequate techniques, which are, without doubt, those related to computing with words.

Such proposals imply certain revisions of some theoretic aspects, especially in relation with fuzzy ordering of the preferences. Also they require changes in the design, collection, systematization and processing of information. Finally, they would need to improve the fuzzy inference models in order to contrast theories, to carry out predictions and to incorporate the necessary statistical appraisals on their reliability.

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